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YOUNG & JATLOW

2300 N STREET, N. W.  
SUITE 600  
WASHINGTON, D. C. 20037

DAVID C. JATLOW  
FRANCIS L. YOUNG\*  
\*ADMITTED IN TEXAS

MAY 28 1993  
FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

TELEPHONE  
(202) 663-9080  
TELEFAX  
(202) 331-8001

May 28, 1993

Ms. Donna R. Searcy, Secretary  
Federal Communications Commission  
1919 M Street, N.W.  
Washington, D.C. 20554

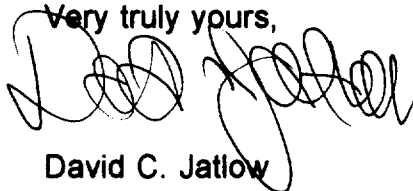
In re: PR Docket No. 92-235  
Comments of Ericsson GE Mobile Communications, Inc.  
and The Ericsson Corporation

Dear Ms. Searcy:

Transmitted herewith on behalf of Ericsson GE Mobile Communications, Inc.  
and The Ericsson Corporation, is an original and nine copies of their comments for  
filing in the above-referenced proceeding.

Should there be any questions with regard to this matter, kindly communicate  
directly with the undersigned.

Very truly yours,



David C. Jatlow  
Counsel for Ericsson GE Mobile  
Communications, Inc. and The Ericsson  
Corporation

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Before the  
Federal Communications Commission

FEDERAL COMMUNICATIONS COMMISSION

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## Summary

Ericsson supports the Commission's goal of adopting rules which will "Refarm" the PLMR spectrum below 512 MHz. Ericsson believes it is important for the PLMR community to be able to use efficient technologies in this presently overcrowded band to provide state of the technology voice and high speed data services. Though Ericsson supports the Commission's proposal to adopt a spectrum efficiency standard to accomplish its goal, it does not believe the Commission's approach to the Refarming issue will result in the most efficient use of spectrum. Indeed, Ericsson believes the Commission's ostensible commitment to achieve spectrum efficiency by splitting existing 25 kHz and 30 kHz channels into very narrowband 6.25 kHz and 5 kHz channels

any theoretical capacity gains caused by the reduction in deviation and is certain to cause interference to existing equipment. Further, after the transmitter deviation reduction is accomplished the PLMR community will still have to purchase entirely new, VNB systems.

VNB equipment does not exist today in any significant quantities. The technical viability of VNB systems is also subject to question because the substantially reduced bandwidth will magnify problems related to impulse noise, intermodulation, rapid flutter, fading, multipath and frequency stability. Indeed, the Commission's 1991 decision authorizing 5 kHz VNB technology for the 220-222 MHz band was supposed to be the testing ground for this unproven technology. However, since no commercial systems exist in that band, one can assume that VNB technology is still unproven--especially for use in an already crowded band.

Existing, proven, wider bandwidth systems such as TDMA

may -- which are capable of providing a significant increase in capacity

rules which interleave 6.25 kHz and 5 kHz channels throughout the Refarming band make it extremely difficult to implement systems based on any technology other than VNB.

Ericsson believes the Commission's goals of Refarming the PLMR band below 512 MHz can be accomplished if it adopts rules which support the following:

1. Adoption of a spectrum efficiency standard by an industry group composed of all interested members of the public (including the Commission) designed to substantially increase spectrum efficiency to a level which is the equivalent of at least 4 communications links per 25 kHz analog channel.
2. Adoption of rules which support flexibility and which allows the PLMR user to determine the particular technology which best suits its needs and which does not discriminate against any type of digital system. Such rules should include a reduction in the number of band classes as well as stacking of contiguous channels within each band to permit wideband or VNB systems to be easily implemented.
3. The use of digital technology.
4. The permissive use of trunking techniques in the PLMR band below 512 MHz.

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Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

In the Matter of )  
 )  
Replacement of Part 90 by Part ) PR Docket No. 92-235  
88 to Revise the Private Land )  
Mobile Radio Services and Modify )  
the Policies Governing Them )  
 )

To: The Commission

**Comments of Ericsson GE Mobile Communications, Inc.  
and The Ericsson Corporation**

Ericsson GE Mobile Communications, Inc. and The Ericsson Corporation (collectively referred to herein as "Ericsson") submit their comments in the above-captioned proceeding. In support thereof, Ericsson states as follows:

**I. Introduction**

The express purpose in initiating the instant proceeding is to change the rules relating to Private Land Mobile Radio ("PLMR") spectrum below 512 MHz so it does not "...deteriorate to the point of endangering public safety and the national economy."<sup>1</sup> The Commission's recognition that this proceeding was necessary is based on universal acknowledgement that the PLMR spectrum below 512 MHz is extremely congested in many areas of the country and, due to historical factors, does not generally use advanced technologies which create the most efficient use of

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<sup>1</sup> Notice of Proposed Rule Making, PR Docket No. 92-235, 7 FCC Rcd 8105, released November 6, 1992, para. 2 (hereinafter "NPRM").

spectrum. Indeed, the use of spectrally efficient technologies is generally precluded in the PLMR band below 512 MHz.

To accomplish the desired result the Commission proposes to change the PLMR rules in the band below 512 MHz in four major

ways. First, it proposes a spectrum efficiency standard

As demonstrated below in greater detail, Ericsson asserts that there are technical problems inherent in the use of VNB technology and the Commission's proposal will delay the capacity gains sought for the PLMR band below 512 MHz. Also, the FCC's proposal to mandate the use of VNB channels will serve to thwart technical flexibility and innovation in the PLMR band below 512 MHz that is properly encouraged by the Commission and so desperately needed due to the diverse uses to which the PLMR band is put by a variety of end users.

As a matter of policy, Ericsson supports:

- Adoption of a spectrum efficiency standard by an industry group composed of all interested members of the public (including the Commission) designed to substantially increase spectrum efficiency to a level which is the equivalent of at least 4 "communications links" per 25 kHz analog channel;
- the use of digital technology;
- technical flexibility which allows the PLMR user to determine the particular technology which best suits its needs and which does not discriminate against any type of digital system;
- a channel allocation plan which stacks channels by user group to enable the use of narrowband or wideband channels to accommodate a variety of technologies which will offer the best combination of voice and/or data services as determined by the user, and;
- permissive use of trunking techniques in the PLMR band below 512 MHz.

## **II. Channel Splitting Will Not Accomplish the Commission's Goal**

Ultimately the Commission's goal in the Refarming NPRM is to increase spectrum efficiency by a factor of approximately 4 relative to a standard 25 kHz or 30 kHz analog channel.

Recognizing that there are approximately 12 million users in the PLMR bands below 512 MHz who have significant investment in

acknowledges the second step of its transition period will involve an equipment changeout. The Commission's proposal is flawed in four major respects.

First, contrary to the Commission's assumption, a reduction in transmitter deviation is not necessarily a simple screwdriver adjustment which substitutes for an equipment change. Moreover, a reduction in transmitter deviation is not without significant disadvantages to the end user, viz., increased costs and inconvenience as well as reduced performance.

As mentioned above, there are approximately 12 million existing users in the PLMR band below 512 MHz. Some of the equipment used by these licensees is older equipment which can, in fact, be adjusted by using a screwdriver and other test equipment. Screwdriver adjustments to this equipment can be made in the field without much effort. Nonetheless, assuming 60% of the radios can be changed in this manner, and further, that it costs \$130 per radio to reduce the deviation in this manner<sup>5</sup>, the overall cost to the PLMR industry to reduce transmitter deviation for these radios will amount to approximately \$936,000,000.

Newer equipment used in these bands is not as easily adjusted. For some new equipment it will be necessary to make a software change to reduce the transmitter deviation which, in turn, will require other equipment parameters to be modified. These types of changes require the end user to bring the radio to

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<sup>5</sup> The cost estimates include a marginal cost incurred due to the radio being out of service while the adjustment is being made.

a qualified shop to have the service performed. Assuming the remaining 40% of the radios in the PLMR band can be modified by software changes at a cost of \$150 per radio, the overall cost to the PLMR industry to reduce transmitter deviation for these radios will amount to approximately \$720,000,000.<sup>6</sup>

Second, a simple reduction in transmitter deviation is not likely to create useable pseudo-12.5 kHz channels<sup>7</sup> based on the Commission's proposed channelization scheme. Even assuming for

reduced. The changes to receiver components include, but are not limited to, replacement of receiver filters, modification of squelch activation circuitry and use of improved audio amplifiers<sup>8</sup> and oscillator stability elements. Ericsson estimates the cost to replace or modify such components might be up to \$310 per radio.<sup>9</sup> For more recently manufactured equipment a greater problem is encountered because circuit modifications to this equipment are extremely difficult, if not impossible, to accomplish. This is due to the use of multilayer printed circuit boards which do not allow most field technicians to change or modify any components inside the radio. The design of these radios does not anticipate field modifications. In the unlikely event of a failure of a component, the radios are (1) returned to the manufacturer or a depot which has the highly specialized equipment required to effectuate the repair or (2) the radios are replaced.<sup>10</sup>

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<sup>8</sup> This is especially true for portable units.

<sup>9</sup> In addition, the frequency drift tolerance of the new narrowband channels is simply incompatible with the predetermined limits of radios already in the field. This means essentially that there will be channel drift (due to temperature) that exceeds that tolerated by true narrowband equipment. This incompatibility will manifest itself in either undue interference or loss of range of the pseudo/hybrid system as a function of the temperature encountered by the radios.

<sup>10</sup> The use of multilayer printed circuit boards serves the public interest in three primary ways. First, it prevents licensees from tampering with equipment thereby avoiding the potential to make unauthorized changes to equipment. Second, given an inventory of spare radios, a licensee is not without his or her radio while it is in the shop being fixed. In cases where a radio goes bad, it is replaced on the spot with a new radio. And third, modern packaging techniques made possible due to the

Thus, despite the Commission's belief that the reduction in transmitter deviation is a relatively minor task, the foregoing has demonstrated that it is not. The Commission's first step transition proposal will result in (a) the expenditure by the PLMR industry of more than \$1.5 billion dollars to reduce transmitter deviation alone; (b) the loss of the use of equipment by the PLMR industry for a significant period of time to accomplish the necessary adjustments where possible; and (c) the likely creation of interference, reduced system performance, and other operating problems for existing 25 kHz or 30 kHz equipment which effectively makes pseudo-12.5 kHz channels unusable until

in the continued expansion of the PLMR market, Ericsson urges the Commission to proceed with caution in mandating only one unproven method of accomplishing the efficiency gains sought by this NPRM.

Third, even assuming that significant costs were not associated with a conversion to 12.5 kHz channels based on the Commission's proposal and further assuming that pseudo-12.5 kHz channels could create additional useable channels, Ericsson's analysis of the existing PLMR band below 512 MHz shows that the

resulting in an overall capacity increase of only 19%.<sup>12</sup>

Fourth, the required future use of 6.25 kHz and 5 kHz VNB channels presents a substantial risk to the PLMR user community in view of the fact that VNB technology is unproven technology. In this regard, there is currently no 6.25 kHz equipment in operation and there are a minimum number of licensees using 5 kHz equipment. Indeed, it was only two years ago when the Commission first adopted 5 kHz narrowband technology as the required technology for the 220-222 MHz band. In the Report and Order in PR Docket No. 89-552<sup>13</sup> the Commission noted that narrowband technology was unproven. It stated it was using the 220-222 MHz Proceeding as the testing ground for VNB technology. Specifically, the Commission stated that it "...initiated the reallocation proceeding....to provide a home for development of narrowband technologies".<sup>14</sup>

Technical problems with VNB technology in general are related to the engineering principle that when the bandwidth of a radio channel is severely reduced to create VNB channels as

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<sup>12</sup> Moreover, if one considers the Public Safety channels in the 800 MHz band, only 46 channels out of a presently existing 299 channels would be created by channel splitting. This would reduce the overall "capacity increase" realized by channel splitting to just 17%. Though the 800 MHz band is not the subject of this proceeding, Ericsson believes its relevancy lies in the fact that the Commission's decision in this proceeding is likely to be used as precedent for similar PLMR proceedings in

proposed by the Refarming NPRM, one can assume impulse noise, intermodulation, rapid flutter, fading, multipath and frequency stability problems will be magnified and are certain to reduce to some unknown magnitude the theoretical efficiency gains of VNB channel splitting. In adopting VNB as the mandated technology for the 220 MHz band, the FCC noted that interference would result from the use of VNB technology unless free spectrum was allocated for it:

After evaluating narrowband usage in the 150 MHz private land mobile band, we subsequently determined that full development of narrowband technology cannot be accomplished by the existing provisions for narrowband operations in that band. The steps needed to protect existing land mobile licensees in the 150 MHz band from interference from narrowband systems severely limit the extent to which such systems can be implemented. After evaluating other private land mobile spectrum alternatives, we also determined that the full development of narrowband technology could not be accomplished in any other spectrum presently allocated to the private land mobile radio services. Meaningful development of narrowband technology requires unoccupied spectrum. We

well founded technical concerns have yet to be resolved, Ericsson submits that the Commission has been premature in proposing VNB technology for the heavily occupied PLMR band below 512 MHz.<sup>16</sup>

The foregoing is not intended to suggest that VNB technology can not overcome the acknowledged technical problems inherent in implementation in an extremely congested PLMR band. Perhaps the experiment with narrowband technology in the 220-222 MHz band will shed light on the viability of this technology. Neither is the foregoing intended to preclude the use of VNB technology in the PLMR band below 512 MHz since Ericsson and many other participants in the Refarming NOI and related proceedings<sup>17</sup> have argued for technical flexibility to accomplish the intended purposes of Refarming in the band below 512 MHz. Rather, the foregoing discussion is to suggest that in a crowded band with 12 million existing users, the theoretical efficiencies to be gained by VNB channel splitting are too speculative at this point relative to the technical deficiencies to make VNB the "benchmark" technology. The strong preference for VNB technology at this time, in Ericsson's opinion, would seriously jeopardize

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<sup>16</sup> Ericsson also notes that the Commission expresses the view that comments submitted in the Refarming NOI clearly indicate narrowband technology should be the benchmark technology for the PLMR band below 512 MHz. However, neither the cited comments AT&T, TIA and/or Motorola supported the use of VNB technology. Ericsson, TIA, AT&T, LMCC and Motorola specifically urged that the Commission establish a regulatory scheme that provided technical flexibility for a variety of technologies.

<sup>17</sup> These proceedings include the FCC/Annenberg Program on Refarming as well as various Roundtable and Brown Bag discussions sponsored by the FCC dealing with the Refarming issues.

the communications capability of the PLMR community. As an alternative to mandating the use of VNB technology as the "benchmark" technology for the below 512 MHz PLMR band, Ericsson submits the Commission has less speculative options to accomplish the desired result as will be discussed below.

### **III. Means To Achieve The Overall Goal of Refarming**

#### **A. Need For A Spectrum Efficiency Standard**

At the heart of the Commission's initiation of this NPRM is the well recognized need to make the PLMR band below 512 MHz spectrally more efficient and capable of accommodating new technologies to meet the demands of the PLMR community. Indeed, in the very first paragraph of the Refarming NPRM the Commission stated "...this Notice of Proposed Rule Making...contains a comprehensive set of proposals designed to increase channel capacity in these bands [and] to promote more efficient use of the channels..."<sup>18</sup> To accomplish its goal the Commission proposes a spectrum efficiency standard.

Ericsson fully supports the adoption of a spectrum efficiency standard for this band. Its comments in the Refarming NOI expressly advocated this course of action. However, Ericsson does not support the spectrum efficiency standard proposed in the Refarming NPRM which is premised on the use of one technology and, further, which does not provide a technical framework and/or equivalent opportunities for manufacturers to meet the desired

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<sup>18</sup> NPRM, supra. at para. 1.

objectives by providing other innovative technical solutions to the Refarming enigma.

The Commission expressly bases its spectrum efficiency standard on the use of VNB technology. That is, the Commission ultimately seeks to split existing PLMR radio channels into 6.25 kHz and 5 kHz VNB channels to obtain an expected spectrum efficiency increase of approximately 4-1 compared to the use of existing analog technology in the PLMR band below 512 MHz. Though the FCC claims its proposal also takes into account alternative technologies such as TDMA, the rules proposed and the allocation tables presented do not encourage the use of technologies other than VNB.

As one example, proposed Section 88.433 specifically allows the use of non-standard bandwidth channels as long as the relevant technologies provide one communications link per 5 kHz for VHF frequencies and one communications link per 6.25 kHz for UHF frequencies. To encourage the transition to VNB technology earlier than the deadlines established in proposed Section 88.433, the Commission provides PLMR licensees in the Refarming band with an incentive to convert to VNB technology. Proposed Section 88.245(b) allows licensees who migrate to VNB technology two years before the appropriate deadline to keep two unloaded channel pairs. There is a similar incentive for licensees whose systems use non-standard (i.e., non-VNB) bandwidths. However, the burden that non-standard systems must meet is considerably higher than that for VNB systems. Proposed Section 88.245(c)

allows licensees which use non-standard bandwidth systems to keep up to two unloaded channels if, and only if, they can demonstrate they exceed the VNB spectrum efficiency standard by 25%. The proposed rule requiring non-standard bandwidth technologies to be at least 25% more efficient than VNB technology in order to qualify for the same benefit demonstrates a clear intent to discourage the use of any technology but VNB.<sup>19</sup>

Ericsson believes the better course of action for the Commission to take is to establish a spectrum efficiency standard for the Refarming band below 512 MHz which is not based on any particular technology but is based on the ability of a system to provide a given quantity of telecommunications voice and/or data traffic. This would accomplish the universally acknowledged need to increase spectrum efficiency in the PLMR band below 512 MHz on the one hand and would also allow manufacturers and users alike to implement a wide variety of advanced technology systems that better meet the needs of the user community on the other hand.

Ericsson believes the most germane measure of spectrum efficiency for PLMR systems is measured in terms of the quantity of communications achieved per unit of occupied spectrum as a function of the geographic area occupied by the signal and the time required to achieve the communications. The critical point is that adoption of a spectrum efficiency standard will accomplish the Commission's goal without arbitrarily preventing

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<sup>19</sup> The very use of the term "non-standard" to describe non-VNB technology is evidence of the Commission's bias against non-VNB technology.

implementation of a wide variety of technical solutions in the frequency band in question.

Ericsson recognizes that promulgation of a spectrum efficiency standard is not an easy task, especially due to the diverse needs of users in the PLMR band below 512 MHz. Thus, Ericsson believes the most equitable manner in which to adopt a spectrum efficiency standard is through development of a concept requiring the consensus and inputs of the PLMR industry as a whole. In this regard, it should be noted that TIA has formed an Ad Hoc Spectrum Efficiency Committee. This Committee has been formed specifically to undertake the task of defining spectrum efficiency. The Committee consists of representatives from the manufacturing community, NTIA and TIA and is open to all interested parties who wish to participate. Ericsson believes this Committee or a similar organization led by the FCC or NTIA is the appropriate vehicle to develop the requisite spectrum efficiency standards and definitions.

**B. Need For A Level Technical Playing Field And  
Technical Flexibility**

Once the Commission establishes the level or levels of spectrum efficiency desired for the PLMR band below 512 MHz as well as the date by which such standards must be met, rules should be adopted which provide a level playing field and provide maximum technical flexibility to allow a variety of technologies to compete in the marketplace based on the particularized needs



day to day business.

Though VNB systems using 5 kHz and 6.25 kHz bandwidths can accommodate data transmission, one must question whether the extremely slow transmission speed capable of being attained with a VNB channel even makes it practical to attempt to transmit such data via radio. This must be contrasted with the fact that wider bandwidth systems such as 12.5 kHz or 25 kHz TDMA systems can certainly transfer this type of data much more quickly and efficiently. With technology existing today, wider bandwidth systems can transmit channel data rates up to 32 kb/s with application rates up to 19.2 kb/s making the delivery of this type of graphic intelligence a reality in the marketplace. More importantly, the transmission of graphic information in a reasonable timeframe will be a tremendous boon to Public Safety officers in the field.<sup>21</sup>

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<sup>21</sup> Ericsson fears that VNB technology as proposed by the

#### **IV. Minimum Technical Standards Required**

Having established a spectrum efficiency standard which will have to be met by a date certain and having made a commitment to ensure that operating rules for the PLMR band below 512 MHz do not preclude the implementation of any technology, the Commission must still promulgate certain minimum rules to assure that spectrum is utilized as efficiently as possible. Ericsson submits that three broad requirements are essential--the use of digital technology; permissive use of trunking technology; and adoption of a channelization plan which provides the various categories of users access to contiguous bands of spectrum.

##### **A. Digital Technology**

The FCC should require the use of digital technology for the PLMR band below 512 MHz. Digital technology is without question the advanced technology of choice worldwide for implementation of new communications systems. In virtually every frequency band for every new service (terrestrial and satellite) manufacturers are devoting their efforts to the development in the field of

